



# Water Quality Below Glen Canyon Dam and Reaeration of Releases

**Bill Vernieu**

Technical Work Group Meeting

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# Lake Powell Hydrology

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- Surface elevation - 3555 ft on April 8, 2005
- Lowest elevation since May 1969
- 38 % of total capacity
- 145 ft below full pool elevation of 3700 ft
- Large amount of deltaic sediment exposed in inflow areas



# 2005 Inflow to Lake Powell

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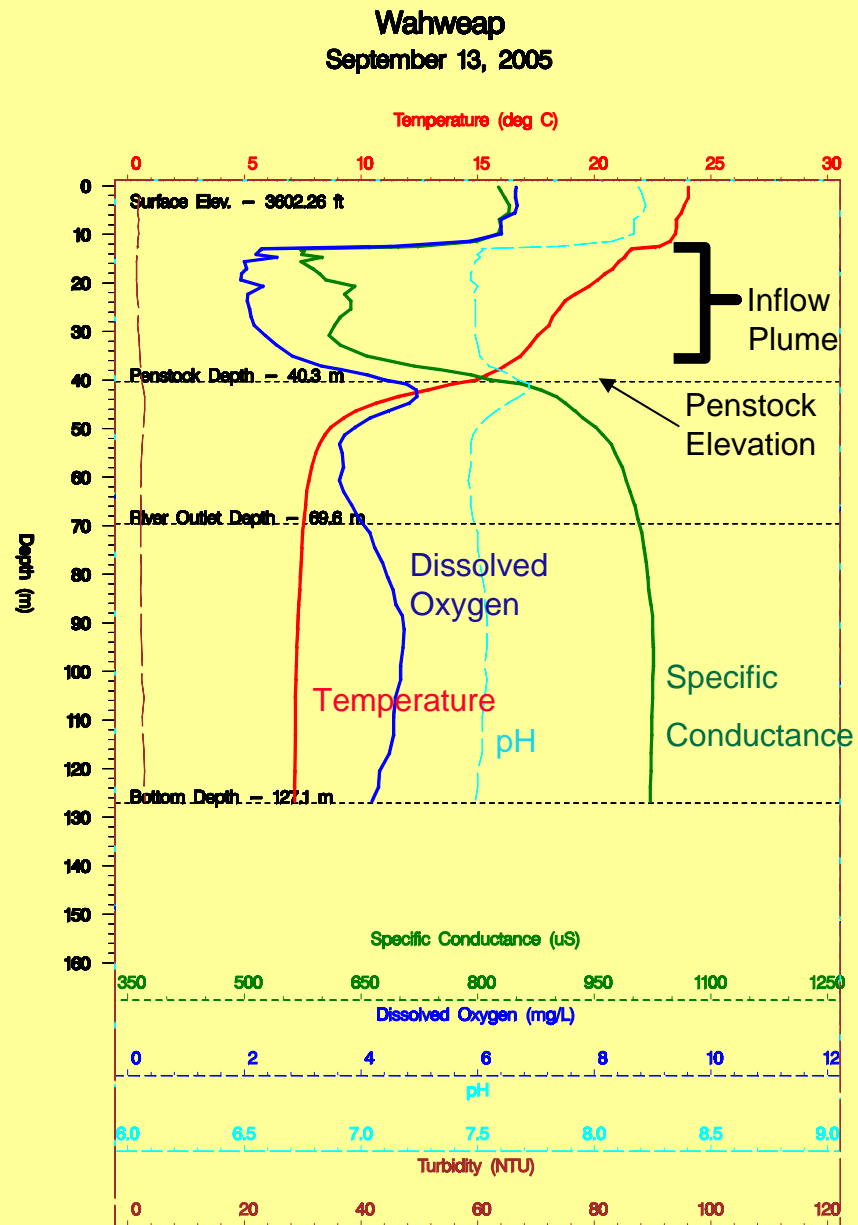
- Apr-Jul 2005 unregulated inflow 8.813 maf
- 111% of normal
- Surface elevation - 3608 ft on July 13, 2005
- Increase of 53 ft in 2005
- Resuspension of large amount of sediment from inflow areas
- Resulted in low dissolved oxygen levels in inflow plume as it traveled through reservoir

# Forebay Water Quality

September 13, 2005

Inflow plume beginning to affect  
Glen Canyon Dam releases

- Inflow plume
  - 13m-38m
  - Minimum D.O. 1.9 mg/L
- Glen Canyon Dam Release
  - T - 14.5 °C (58 °F)
  - D.O. - 4.5 mg/L (51 %)



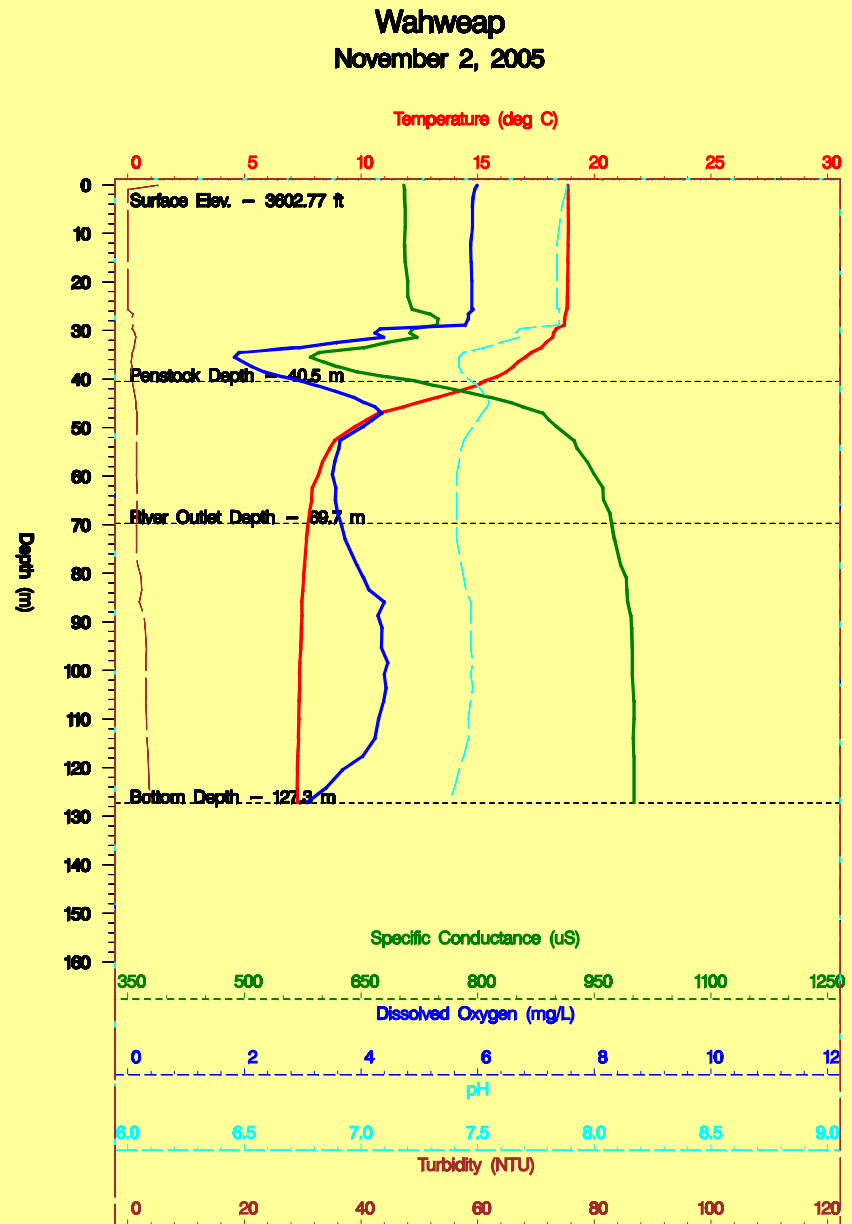
# Forebay Water Quality

November 2, 2005

Surface of reservoir mixing

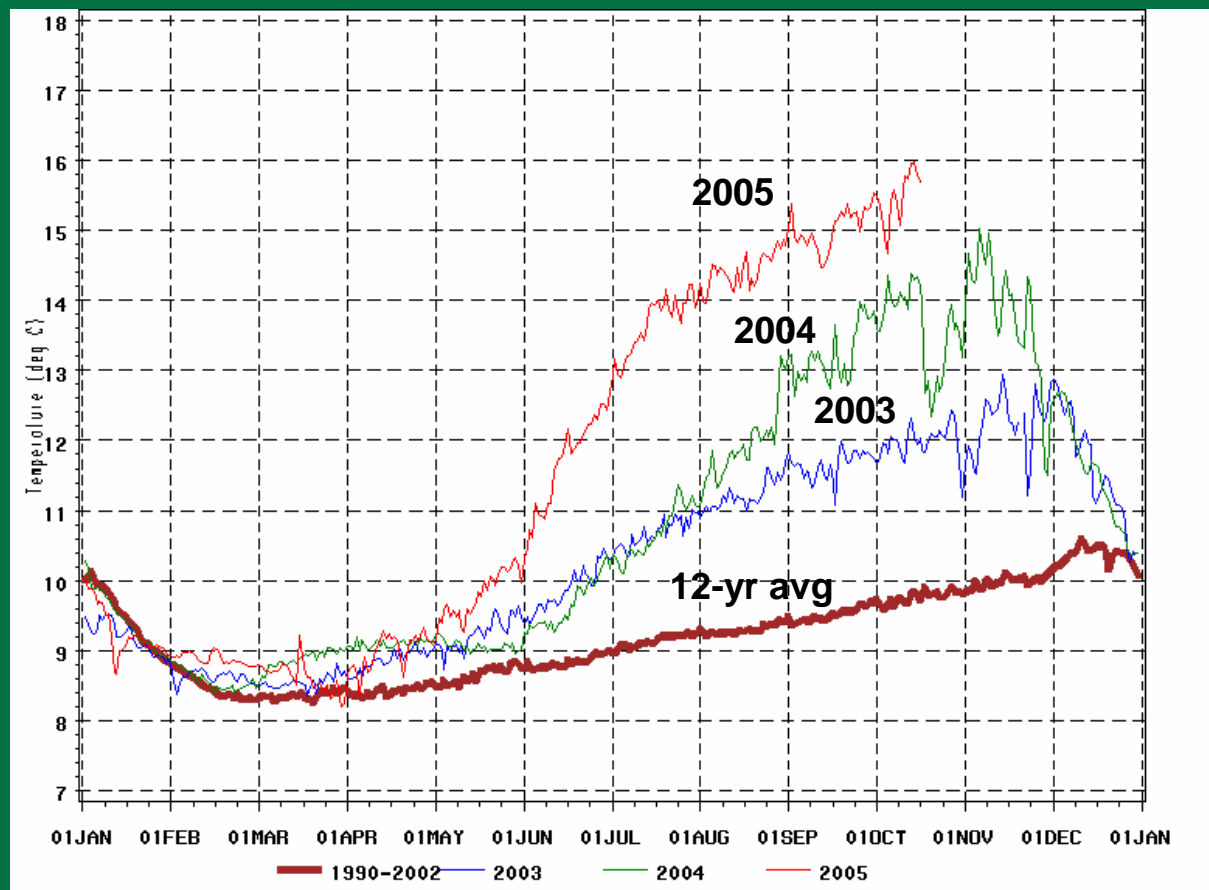
Release WQ further affected

- Inflow plume
  - 28m-40m
  - Minimum D.O. 1.7 mg/L
- Glen Canyon Dam Release
  - T - 15.8 °C (58 °F)
  - D.O. - 3.6 mg/L (41 %)



# Glen Canyon Dam Release Temperature

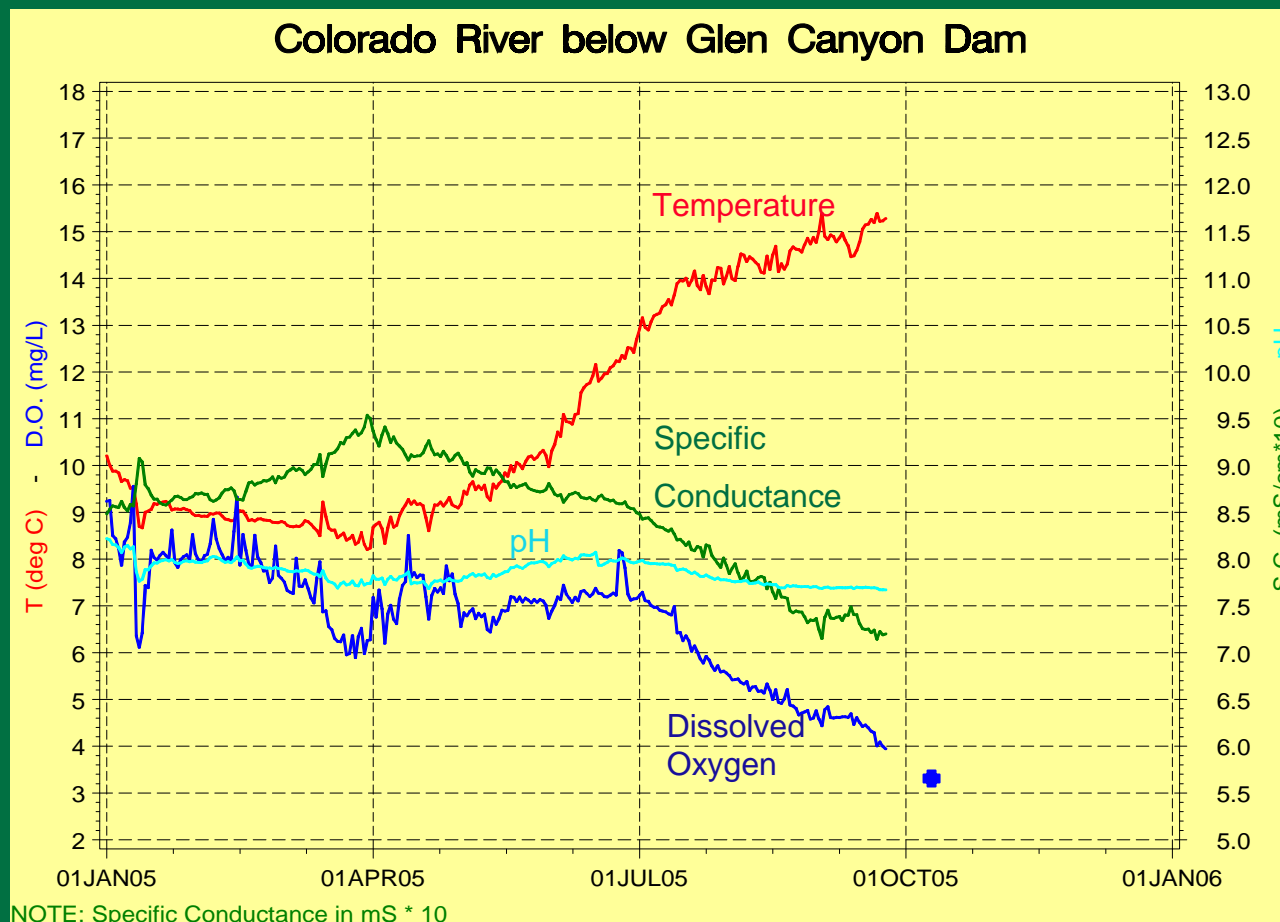
- Warmest releases since 1971
- 16°C (61°F) on October 8, 2005
- 6°C above 12-yr average



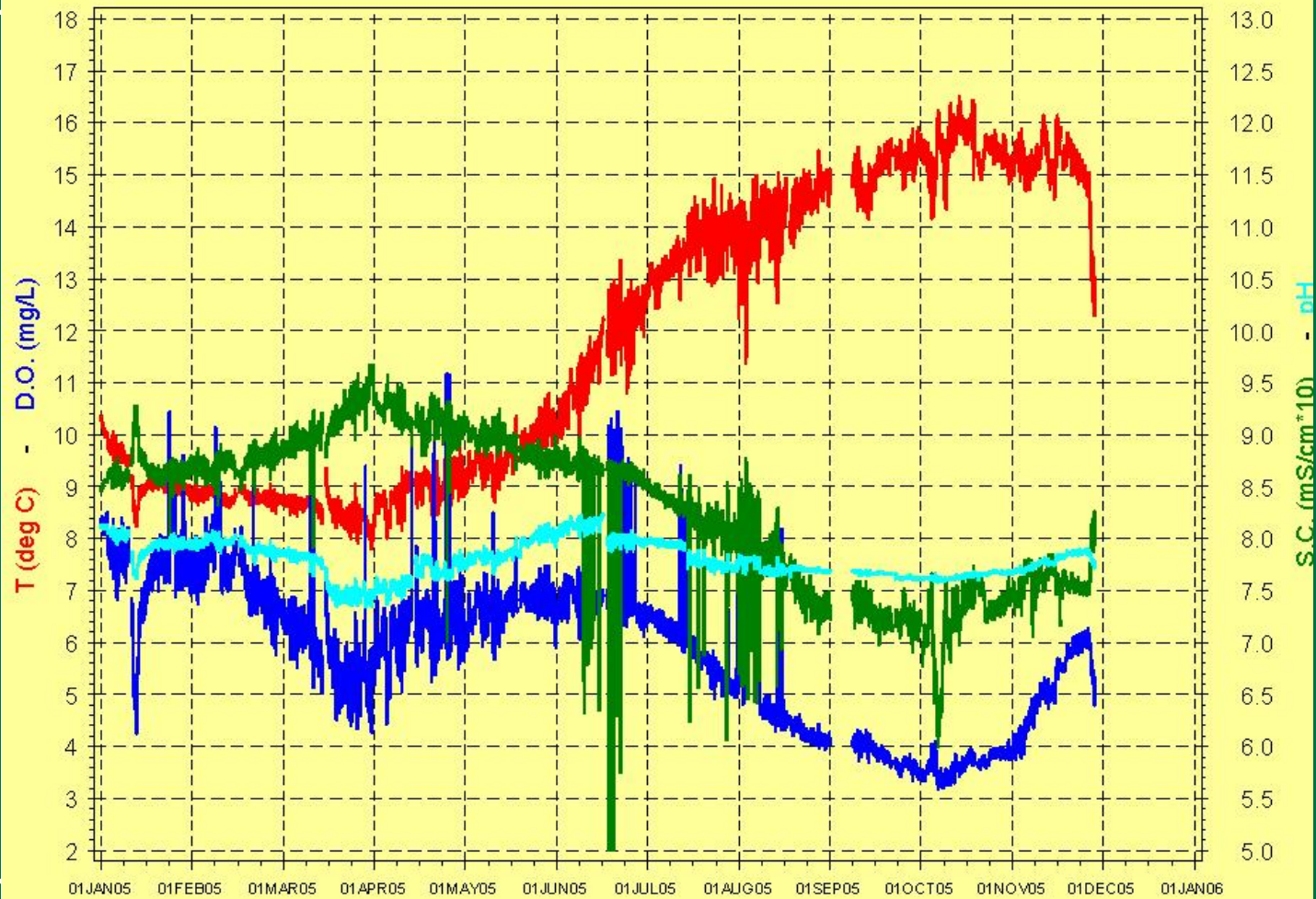
# Glen Canyon Dam Releases 2005

Mean daily values

- Lowest dissolved oxygen on record (since 1990)
- 4.0 mg/L on September 25, 2005
- 3.3 mg/L on October 8, 2005 from draft tubes



## Glen Canyon Dam Draft Tube



NOTE: Specific Conductance in mS \* 10

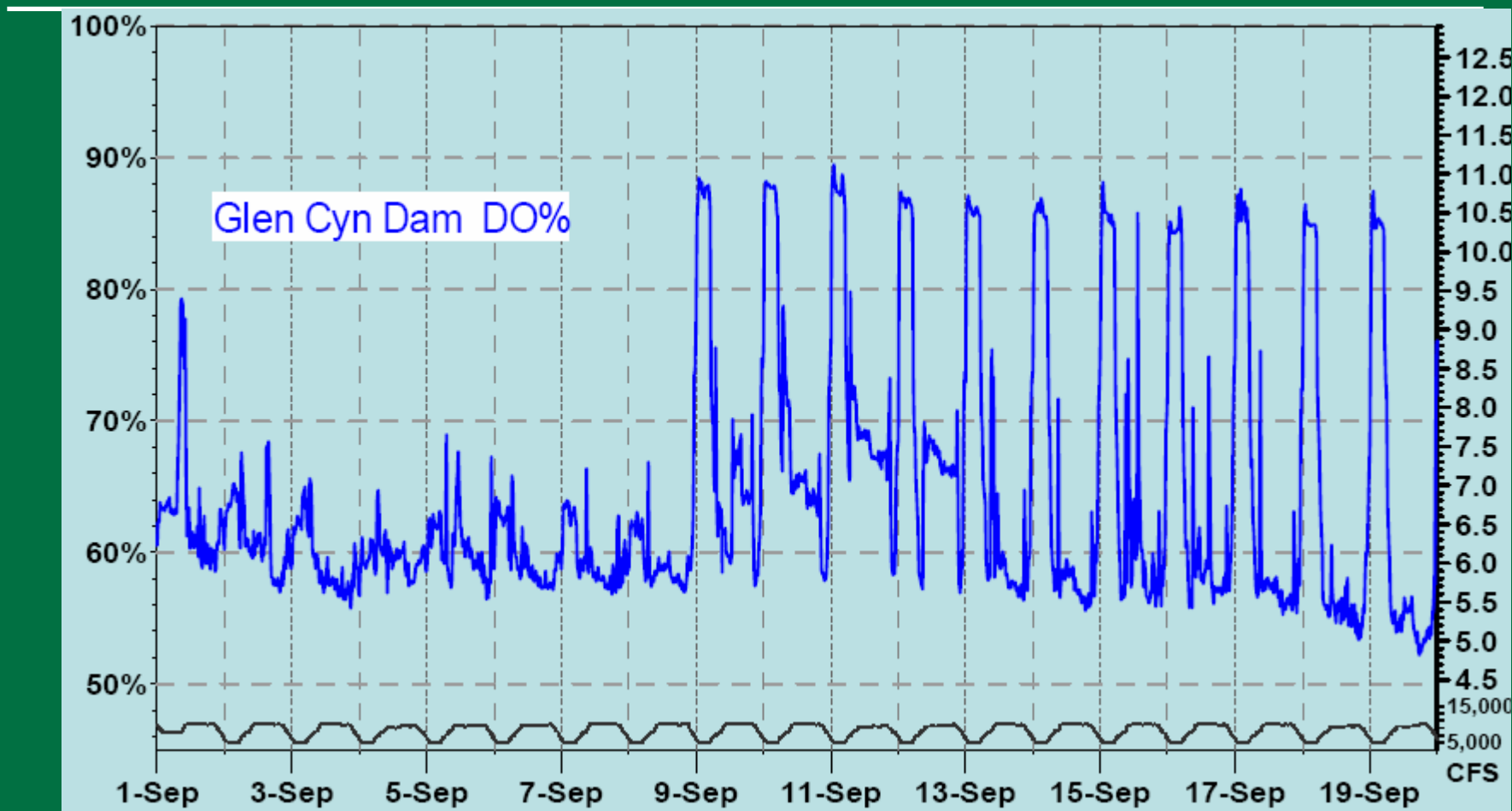


# Reaeration of Dam Releases

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- Past monitoring data has shown elevated dissolved oxygen levels in GCD tailwater during nighttime hours (~11 pm to ~7 am)
  - These spikes appear to be associated with low discharge levels from individual turbines
  - Turbine discharges resulting in maximum reaeration of releases may cause inefficient power generation and damage to turbines
  - Reclamation has experimented with various operational regimes during recent experimental flow period to achieve optimal balance
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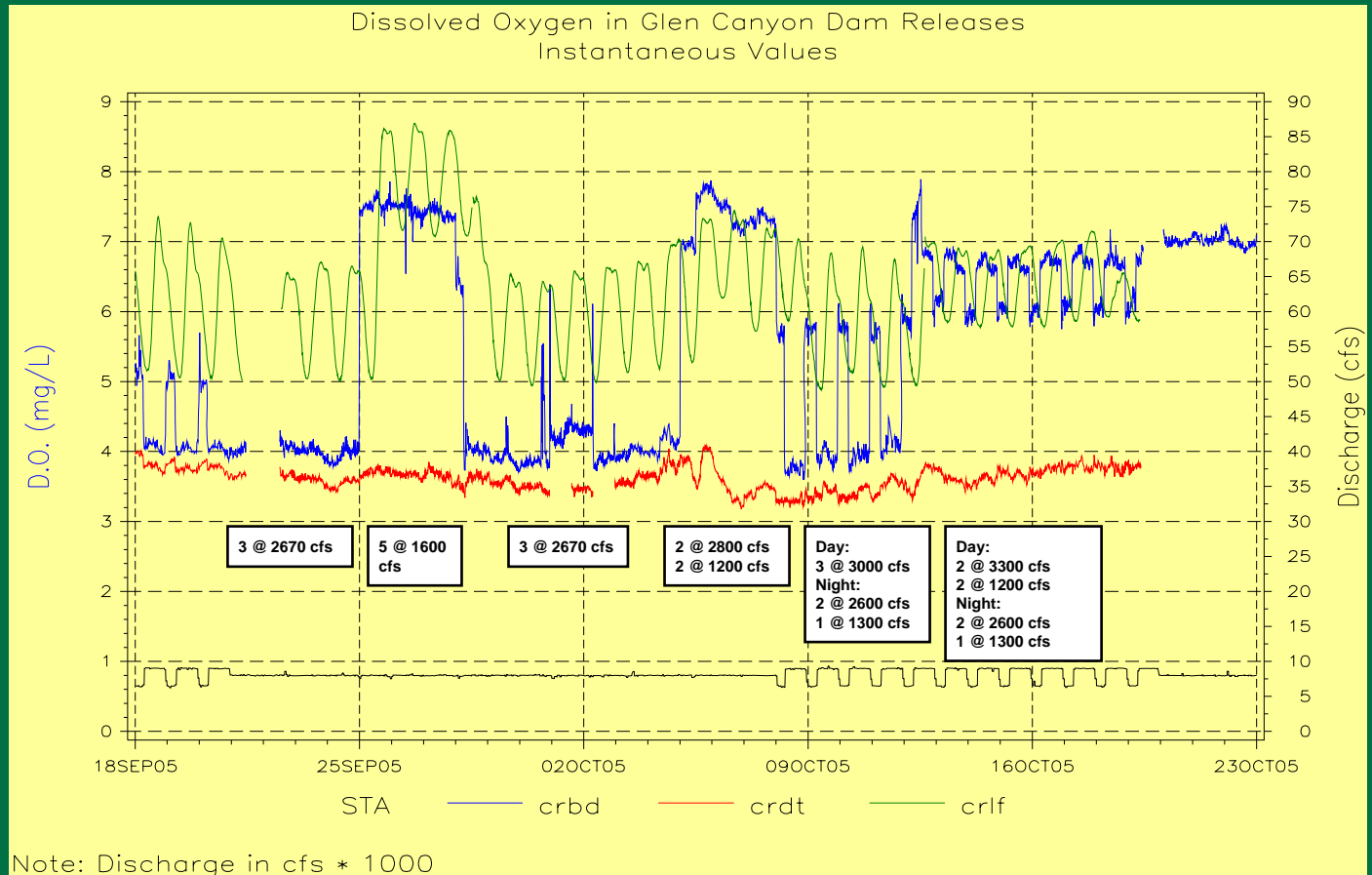
# Nighttime Reaeration Spikes - 2005



# Reaeration Experiment

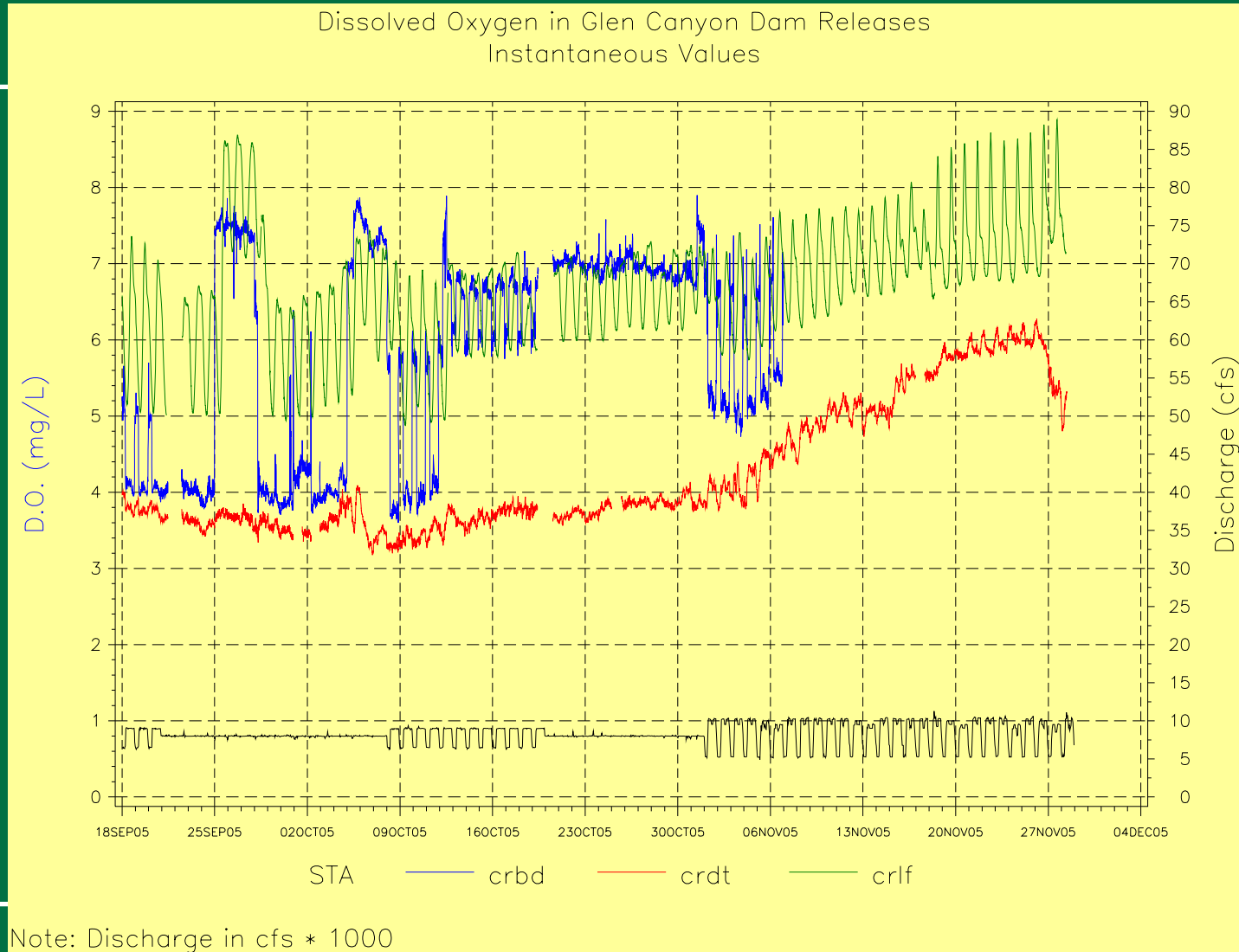
Long-term monitoring at three locations:

- CRDT (red)  
GCD Draft Tube
- CRBD (blue)  
GCD tailwater
- CRLF (green)  
Lees Ferry



# Recent Release Water Quality

- D.O. in tailwater (blue line) reduced with cessation of experimental flows
- Displaying nighttime D.O. spikes
- Increase in draft tube D.O. (red line) indicating reservoir mixing



# Conclusions

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- D.O. in tailwater affected by GCD release concentrations, turbine operations, atmospheric equilibration and photosynthetic productivity
- Certain aspects of dam operations can cause significant aeration in the GCD tailwater
- Concerns remain about low operating efficiency and damage to powerplant machinery
- Reaeration observed in CRBD station persists throughout tailwater
- Cooperative effort between Bureau of Reclamation, Arizona Game & Fish, GCMRC, environmental groups